GUIDELINES FOR THE DESIGN AND APPROVAL OF WATER SUPPLY SYSTEMS FOR SMALL MUNICIPAL DEVELOPMENTS

Alberta
ENVIRONMENT

GUIDELINES FOR THE DESIGN AND APPROVAL OF WATER SUPPLY SYSTEMS FOR SMALL MUNICIPAL DEVELOPMENTS

Prepared by:

Alberta Environment

Standards and Approvals Division

Municipal Engineering Branch

August, 1986

TABLE OF CONTENTS

		Page(s)
TABLE OF CONTENTS		i
PREFACE		ii-iii
SECTION 1	INTRODUCTION	1.1-1.2
SECTION 2	APPLICATION FOR A PERMIT TO CONSTRUCT	2.1-2.3
SECTION 3	APPLICATION FOR A LICENCE TO OPERATE	3.1
SECTION 4	DESIGN CONSIDERATIONS FOR WATER SOURCES	4.1
SECTION 5	LOCATION OF A WATER SUPPLY WELL	5.1
SECTION 6	CONSTRUCTION OF A WATER SUPPLY WELL	6.1
SECTION 7	DISINFECTION OF A NEW OR RECLAIMED WELL	7.1
SECTION 8	OTHER CRITERIA FOR WATER SUPPLY WELLS	8.1
SECTION 9	DESIGN CONSIDERATIONS FOR WATER TREATMENT AND STORAGE FACILITIES	9.1-9.2
SECTION 10	DESIGN CONSIDERATIONS FOR WATER TRANSMISSION MAINS	10.1-10.3
SECTION 11	OPERATION AND MAINTENANCE	11.1

PREFACE

These guidelines outline Alberta Environment requirements pursuant to the Alberta Clean Water Act for the design and approval of water supply systems serving small municipal developments in Alberta.

These guidelines apply to any unincorporated rural development of four or more residences being served by a communal water supply system, or to any school not connected to a municipal water system. The requirements outlined in these guidelines do not apply to rural developments of two or three residences served by a communal water supply system, although under the Clean Water Act it is still necessary to obtain a Permit to Construct for any communal water system serving more than one residence when each of the residential lots is individually owned. These guidelines also do not apply to a communal water supply system serving a single farm site on which there is more than one residence, nor is a Permit to Construct required for such. In general, it is the position of Alberta Environment that whenever possible, individual private water wells should be used to service private developments. However, when communal water supply systems are to be installed for small municipal developments, these guidelines shall be used for the purpose of engineering design and to obtain environmental approval. The guidelines specify criteria which should be used in evaluating and developing surface and ground water supply sources; they also outline specific design criteria for water treatment plants, water storage facilities, and water transmission mains.

The procedures for obtaining a Permit to Construct and Licence to Operate for communal water supply systems serving small municipal developments are also described in these guidelines. Construction approval for such communal water supply systems will only be considered if the following conditions are met:

1. the rural municipality favours the proposed development and is in agreement with the concept of a communal water supply for the proposed development;

2. the rural municipality has no objections to the detailed engineering drawings for the communal water supply system; and

3. Alberta Environment is satisfied that the system meets the standards outlined in these guidelines in addition to any other relevant guidelines, standards, or regulations.

These guidelines do not apply to existing communal water supply systems, however existing systems which are upgraded will be required to meet the design standards of these guidelines. Permits to Construct and Licences to Operate for such upgraded systems will be issued either to the owner(s) of the system or the rural municipality, whichever the rural municipality requests.

SECTION 1

INTRODUCTION

There are an increasing number of private developments in Alberta, particularly rural or country residential subdivisions, and it appears that the trend towards this type of development will continue in the future. The servicing of these developments with water supply and sewage facilities may require approvals from Alberta Environment pursuant to both the Water Resources and Clean Water Acts.

The Water Resources Act applies to groundwater supply facilities that discharge into a communal water distribution system. Proponents of these facilities must meet the requirements and also obtain the approvals as outlined in the document entitled "Evaluation Standard and Technical Report Requirement - Groundwater Supply for Residential Subdivisions with Distribution" (Alberta Environment, 1979). The Act also applies to surface waters that are diverted for potable use, in which case it is necessary to obtain a Licence from the Controller of Water Resources.

Communal sewage collection and treatment systems are subject to the requirements of the Clean Water Act, and specific standards for sewage lagoons serving private developments have been established and are entitled "Recommended Guidelines for the Design, Approval and Operation of Sewage Lagoons for Small Municipal Developments" (Alberta Environment, 1977, revised 1986).

The requirements for water supply systems for small municipal developments pursuant to the Alberta Clean Water Act are outlined in these guidelines. For the purposes of the guidelines, a small municipal development being served by a communal water system is defined as either:

1. any development consisting of four or more individually owned residential units or separate land parcels; or

2. any school that is not located in a City, Town, Village, Summer Village or Hamlet.

These guidelines, however, do not apply to:

1. four or more residences located on a single farm site; or

2. three residences or less located either on separate parcels of land or on communal property.

For the purposes of these guidelines, a water supply system includes the source of water, treatment works, storage reservoirs, transmission mains, and any appurtenances that serve any development other than a single family dwelling. A water supply system does not include that part of the water transmission system from the property line to the residence being served. This service connection component is subject to Alberta Labour's Plumbing and Drainage Act Regulations.

It is Alberta Environment's position that residences in rural subdivisions should be serviced individually with private water wells unless:

1. the local aquifiers are such that all lots cannot be serviced by private wells;

2. ground water quality dictates that a central water treatment facility be provided; or

3. surface water is the only satisfactory water supply source.

Where one or more of these conditions exists, installation of water supply systems for rural subdivisions may be considered if the rural municipality favours the proposed development and agrees in-principal with the concept of a communal water supply for the proposed development, and the rural municipality has no objection to the detailed engineering drawings for the communal water supply system.

SECTION 2

APPLICATION FOR A PERMIT TO CONSTRUCT

When a municipal water supply system (as defined in these guidelines) is to be installed, it shall be designed to meet requirements outlined in these guidelines. Pursuant to Section 3 of the Clean Water Act and Section 4 of the Clean Water (Municipal Plants) Regulations, a municipal water supply system shall not be constructed without a Permit to Construct from the Director of Standards and Approvals, Alberta Environment.

Permit to Construct applications must be made directly by either the rural municipality in which the development is located or by the ultimate owner of the water system (or by an agent acting on their behalf). With the exception of water systems serving school district developments, Permits to Construct for systems meeting Alberta Environment's requirements and having the approval of the rural municipality will be issued only to the rural municipality or the ultimate owner of the system. School Divisions may make application directly to Alberta Environment for Permits to Construct for water supply systems serving school developments, and said Permits will be issued directly to the School Division providing that the system meets Alberta Environment requirements and is acceptable to the rural municipality.

To apply for this Permit, the following information must be submitted to the Director, Standards and Approvals Division, Alberta Environment, 4th Floor, Oxbridge Place, 9820 - 106 Street, EDMONTON, Alberta, T5K 2J6.

1. A letter outlining:
   a) the legal land description of the proposed development;
   b) the number of lots in the proposed development or the design population of the proposed development;
   c) the projected water usage in the proposed development;
   d) the name of the company and/or person(s) owning the development;
   e) a brief description of the water supply system being proposed; and,

f) an estimate of the cost of the water supply system.

2. Engineering plans of the water supply system, stamped and signed by a Professional Engineer, including:

   a) an overall area plan, and
   b) plans and profiles of all mechanical components, piping, structures, etc., associated with the water supply system.

3. Specifications of all mechanical, electrical, structural and control components associated with the water supply system. Specifications for treatment components should include data on capacity and efficiency.

4. If groundwater is the source of potable water for the water supply system, a copy of the Alberta Environment Water Resources Exploration Permit.

5. A physical, chemical and bacteriological analysis of the proposed water supply source. The following parameters shall be included in the analysis:

   a. colour (TCU);
   b. turbidity (NTU);
   c. phenols (mg/L);
   d. pH;
   e. dissolved iron (mg/L);
   f. zinc (mg/L);
   g. sulphide (mg/L as H_2S);
   h. calcium (mg/L);
   i. magnesium (mg/L);
   j. sodium (mg/L);
   k. manganese (mg/L);
   l. chloride (mg/L);
   m. copper (mg/L);
   n. arsenic (mg/L);
   o. lead (mg/L);
   p. mercury (mg/L);
   q. fluoride (mg/L);
   r. nitrite & nitrate (mg/L as N);
   s. sulphate (mg/L as SO_4);
   t. total hardness (mg/L as $CaCO_3$);
   u. total alkalinity (mg/L as $CaCO_3$);
   v. total dissolved solids (mg/L);
   w. total coliforms (mpn/100 ml);
   x. fecal coliforms (mpn/100 ml); and
   y. ammonia (mg/L).

NOTE: Drinking water must meet the health related quality criteria outlined in Health and Welfare Canada's publication entitled Guidelines for Canadian Drinking Water Quality, 1978.

6. A letter or development agreement from the rural municipality in which the development is located, indicating the Local Authority's approval of the communal water supply system.

7. The name, address and telephone number of the engineer or certified engineering technologist who will supervise construction of the proposed water supply system. (NOTE: A certificate of completion, signed by a Professional Engineer or Certified Engineering Technologist, indicating that the water supply system was installed as per approved plans and specifications, will be a condition of the Permit to Construct).

SECTION 3

APPLICATION FOR A LICENCE TO OPERATE

In accordance with Section 4 of the Clean Water Act and Section 7 of the Clean Water (Municipal Plants) regulations, the ultimate owner of the municipal water system shall apply for and obtain a Licence to Operate before commencement of system operation.

To apply for this Licence to Operate, the application shall be submitted to the Director, Standards and Approvals Division, Alberta Environment, 4th Floor, Oxbridge Place, 9820 - 106 Street, Edmonton, Alberta, T5K 2J6. The proponent shall also submit "as-built" drawings and an operating and maintenance manual when applying for a Licence. Refer to Section 11 on Operation and Maintenance for details regarding the contents of the manual.

Licence application forms may be obtained from the Municipal Engineering Branch, Standards and Approvals Division of Alberta Environment, 427-5877.

SECTION 4

DESIGN CONSIDERATIONS FOR WATER SOURCES

In selecting the source of water for a small municipal development, the design engineer must satisfy the Water Resources Administration Division and the Standards and Approvals Division staff that sufficient water is available for the development, and that the water to be delivered to the consumers will meet (or can be treated to meet) the current requirements of the Director of Standards and Approvals with respect to bacteriological, physical, and chemical quality.

The following criteria and requirements should be followed when selecting/designing a water source:

1. A Licence from the Surface Water Rights Branch, Water Resources Administration Division, Alberta Environment, must be obtained if water is to be drawn from any surface source;

2. An Exploration Permit from the Ground Water Rights Branch, Water Resources Administration Division, Alberta Environment must be obtained before constructing a water well. A licence is then required from the Ground Water Rights Branch before the well can be used as a water source; and,

3. The source of water should be sufficient to meet the maximium day demand of the proposed development. The minimum daily water demand that should be provided for rural subdivisions is 2000 Litres (440 gallons) per residence per day, and the water supply source should be sufficient to provide this quantity of water for a sustained period of time.

SECTION 5

LOCATION OF A WATER SUPPLY WELL

No well shall be located so that the top of the well is within any building other than an acceptable pump house or water supply system building. The well shall be located a minimum of 3.0 metres (10 feet) from any other building or structure.

Wells must be at least 30 metres (100 feet) from septic tanks and 45 metres (150 feet) from cesspools and subsurface sewage drainfields, and shall be located at the highest point on the premises in relation to the general layout and surroundings. Wells shall also be located as far as possible from known or potential contamination sources. A drawing showing the proximity of the well(s) to possible sources of pollution and indicating the possibility of flooding (high water elevation) shall accompany the Permit to Construct application.

Every well shall be reasonably accessible for repairs and maintenance and shall be located on a legally registered utility lot.

SECTION 6

CONSTRUCTION OF A WATER SUPPLY WELL

A minimum protective depth for drilled wells shall be provided and shall include:

1. watertight construction to a minimum depth of 3.0 metres (10 feet) below ground level;

2. sealing of formations that are (or may be) contaminated, or that could yield undesirable water; and,

3. an annular opening of at least 40 millimetres (1.5 inches) outside the protective casing filled with:

   a) concrete grout; or
   b) neat cement grout; or,
   c) other approved seal material.

In the finished well, the top of the casing shall terminate not less than 200 mm (8 inches) above the concrete floor of the well house and not less than 600 mm (24 inches) above the highest flood level. The well house must be located above grade. The pump installation shall be such as to preclude the possibility of any water (except within the pump piping) from dripping or draining back into the well.

Any power-driven pump located over the well shall be mounted on the well casing, either on a pump foundation or on a pump stand so that the top of the well is effectively sealed. In the event that the pump unit is not located over the well and the pump delivery or suction pipe merges from the top thereof, a water tight seal shall be provided between the well casing and the piping. A similar seal shall be provided at the terminal of a conduit containing suction, submersible, or jet pump piping.

SECTION 7

DISINFECTION OF A NEW OR RECLAIMED WATER SUPPLY WELL

Prior to the use of the well for domestic consumption, the well water shall be disinfected. Chlorine should be applied so that a concentration of 50 milligrams per litre of chlorine is present in the well for a minimum period of two hours (preferably twelve hours). The above approximate concentration may be obtained if either of the following is added to 450 litres (100 gallons) of water:

1. Calcium Hypochlorite (70 percent available chlorine)
   - 0.04 kilograms (0.08 pounds)

2. Bleach (Sodium Hypochlorite)
   - 0.05 litres (0.05 quarts) of 5 percent solution (domestic grade)

   - 0.02 litres (0.02 quarts) of 10 percent solution (commercial grade).

NOTE: Where the well is suspected of having appreciable slime growth or dirt which would create a high chlorine demand, the above dosages of chlorine should be doubled.

Dosages should be computed on the basis of the volume of water in the well. The method of application shall be such as to ensure mixing throughout the well, i.e. recirculation of pumped water.

SECTION 8

OTHER CRITERIA FOR WATER SUPPLY WELLS

The Ground Water Development Act, Chapter G-11.1, and the following regulations pursuant to this Act shall be followed when developing any groundwater supplies:

1. Ground Water Development General Regulation (Alberta Regulation 368/81);

2. Water Well Drilling and Construction Regulation (Alberta Regulation 369/81); and,

3. Ground Water Development Act Form Regulation (Alberta Regulation 370/81).

The American Water Works Association and National Water Well Association standards for deep wells (AWWA A-100-66) and its accompanying Appendix are also suggested as a guide in the design and construction of water supply wells.

SECTION 9

DESIGN CONSIDERATIONS FOR WATER TREATMENT AND STORAGE FACILITIES

In designing water treatment and storage facilities for small municipal developments, the following criteria should be applied:

1. water not meeting the health related quality criteria of the Guidelines for Canadian Drinking Water Quality, 1978 shall be treated to meet these criteria;

2. the minimum treatment required for surface water supplies is filtration and disinfection. Shallow water wells of less than 15 m (50 feet) are to be considered as surface waters with respect to treatment requirements. Coagulation may also be required depending on the nature of the water supply source and type of filtration proposed. Deeper wells do not normally require treatment facilities, however provisions should be made in the design of the treatment system;

3. water treatment units shall be designed and sized to provide drinking water at a rate at least equal to the maximum daily demand;

4. water metering facilities shall be provided as part of the water supply system, and household water metering is recommended;

5. the minimum clear water storage required shall be equal to twice the maximum day water demand. If fire protection is to be provided, the clear water storage volume requirement should be equal to the sum of one day's demand plus fire flow requirements as per Fire Underwriters Survey. (Note: Clear water storage requirements may be waived or reduced if the water supply system is capable of providing potable water at a rate greater than the maximum day demand, however, in such cases a standby water supply pump shall be provided);

6. all mechanical, electrical and control equipment associated with water pumping, water treatment and water storage shall be covered by an all weather structure, and where necessary shall be equipped with heating and ventilation (this equipment shall be housed on a utility lot with right-of-way access);

7. the water supply system should be designed to provide a minimum positive pressure of 140 kPa (20 psig) throughout the distribution system during peak demand flows; and

8. an operating and maintenance manual for all pumps, treatment units and appurtenances shall be provided.

(NOTE: A communal water supply system that distributes raw water and incorporating treatment components at individual residences is not acceptable. Connection of a water well through a pressure tank directly to the distribution system is not acceptable except for small developments, or when standby wells or pumps are provided. The well should pump to the clear water storage facility, and pressure tanks may only be used for pressure control from the clear water storage reservoir to the distribution system. However, a connection from the water well directly to the pressure tank may be installed for use when the clear well requires maintenance).

Equipment and facilities for water treatment and storage shall be selected such that operating and maintenance requirements are minimized but easily carried out when necessary. All equipment and appurtenances shall comply with CSA standards or other standards approved by Alberta Environment, and shall be installed in accordance with the appropriate regulations/requirements of the General Safety Services Division of Alberta Labour. Where disinfection of the water supply is required, the criteria shall be followed as outlined in Alberta Environment's Standards for Water Supply, Sewage Works and Storm Drainage Systems.

SECTION 10

DESIGN CONSIDERATIONS FOR WATER TRANSMISSION MAINS

In designing and constructing water transmission mains and distribution lines for small municipal developments, the following criteria should be applied:

1. the piping material used for the water transmission and distribution network shall comply either with CSA standards applicable to outside underground potable water systems, or with other standards approved by Alberta Environment;

2. the water transmission mains and distribution lines shall be located at least 3 m (10 feet) from any sanitary sewer, storm sewer or sewer manhole;

3. dead-ends should be avoided wherever possible, and transmission and distribution lines looped where possible;

4. valved clean-outs shall be provided at all dead-ends on the transmission and distribution network;

5. isolation valves shall be installed as appropriate, based on the size and configuration of the development being serviced [NOTE: isolation valves every 200 m (650 feet) or after every sixth service connection, whichever is the greater distance, is a recommended guide];

6. there shall be no physical connection between the water transmission and distribution network and any pumps, pipes, hydrants or tanks, whereby unsafe water or other contaminating materials may be discharged or drawn into the system;

7. the water transmission and distribution network shall be capable of withstanding, without leakage or loss of pressure for 15 minutes, a water or air pressure test of not less than 415 kPa (60 psig) or not less than 1.5 times the working pressure, whichever is greater;

8. the minimum diameter of water transmission mains and distribution lines is 150 mm (6 inches), although lesser diameters, to a minimum of 40 mm (1.5 inches) may be considered depending on the size of development being serviced;

9. the water transmission mains and distribution lines shall be installed below frost level;

10. pipe bedding should be as per pipe manufacturer's specifications or recommendations, and pipe trenches shall be backfilled by hand to a height of 300 mm (12 inches) over the top of pipe with material free of stones, boulders, cinders, and frozen earth. The backfill material shall be compacted by mechanical or hand tamper in 150 mm (6 inch) lifts to 95 percent of the soil's maximum density;

11. concrete reaction blocks shall be provided for all plugs, ties, crosses and bends with 22 1/2 degrees or greater deflection;

12. all water transmission and distribution networks shall be thoroughly cleaned and disinfected in accordance with the American Water Works Association AWWA Standard for Disinfecting Water Mains (AWWA C601-81), prior to the network being put in use;

13. all service connections to the water distribution network shall be as per the requirements of the latest edition of the Alberta Labour "Plumbing and Drainage Act Regulations"; and

14. utility right-of-ways should be obtained for all parts of the water transmission and distribution network located on private lands.

SECTION 11

OPERATION AND MAINTENANCE

Regular inspections and routine maintenance of the water supply system must be provided to ensure that the system provides a safe potable water supply throughout its design life. For this reason, "as built" drawings with an operating and maintenance manual for the water supply system must be submitted, along with the application for the Licence to Operate. This manual should provide:

1. a brief description of the total water supply system;

2. a description of the mechanical components in the system;

3. an outline of the operation and maintenance which should be provided for each component in the system; and

4. the suppliers or maintenance firms which should be contacted if problems with the water supply system occur.